Description

Large-capacity vehicle for transporting people, in particular a rail vehicle, having car bodies which are connected in an articulated fashion

The invention relates to a large-capacity vehicle for transporting people, especially a rail vehicle, which has car bodies which are coupled by articulated connections, at least two car bodies of which are respectively supported on a bogie or set of running gear, wherein all the articulated connections permit turning movements of the car bodies about the vertical axis when cornering, and in a vehicle which has more than three parts at least one articulated connection is embodied in such a way that the vehicle can carry out pitching movements about the transversal axis when traveling through a depression or over an elevation.

In the periodical Der Nahverkehr [Local Transportation], No. 6/1996, pages 48 to 53, an innovative shell construction for a modular tram vehicle is described. In the four-part prototype vehicle which is shown in Figure 2 of this reference a car body which is configured in the manner of a bridge (central module) is connected in an articulated fashion to two car bodies which are each supported on a dual-axle set of running gear (dual-axle running gear modules). The prototype vehicle also has a car body which rests on a single-axle set of running gear (single-axle running gear module). The lower articulated connections comprise vehicle joints which can move in a spherical fashion and are rigidly connected to the car bodies by means of brackets. These lower joints, which are disclosed as an assembly in, for example, DE 101 39 970 A1, permit pivoting movements and in theory also pitching and rolling movements. The first embodiment of the above joints which is

arranged between the central module and the two dual-axle running gear modules in the prototype vehicle only permit a

pivoting movement about the vertical axis (z axis). A second embodiment of the above joint which is arranged between the car body with the single-axle running gear module and the central module in the prototype also permits the vehicle to carry out a pitching movement about the transversal axis when traveling through a depression or over an elevation. With this second embodiment of the joints, the car bodies are connected by means of a transversal connector which acts on a respective bracket of the two car bodies.

In the modular vehicle explained above and also in other so-called multi-joint vehicles - see in this respect the periodical Railway Gazette 2003, pages 57 to 64, for example Fig. 4 "Dresden NGTD 6", Fig. 6 "Citadis" and Fig. 7 "Cityrunner" - joints are therefore used which permit either only pivoting of the car bodies about the vertical axis or pivoting and pitching of the car bodies about the vertical axis or about the transversal axis. In certain track situations (such as in particular elevations in the track in bends or twists in the track) torsion may occur in the car bodies resulting in high stresses on the structure of the car bodies. Even if the car bodies are dimensioned to cope with these high stresses, overloading and damage to the car body structures when traveling cannot be ruled out.

The invention is therefore based on the object of embodying a large-capacity vehicle with the generic features in the simplest possible way such that overloading and damage to the car body structures are reliably avoided in all track situations.

This object is achieved according to the invention in such a way that one of the articulated connections has a connecting element which

is embodied and connected to two car bodies in such a way that pivoting and rolling movements about the longitudinal axis of the vehicle are made possible. The connecting element can be embodied as a rigid connector rod and can be connected to the two car bodies via ball and socket joints. Alternatively, it is possible to connect the connecting element as a twistable connector rod and to connect it to the two car bodies via single-axle joints.

Since, according to the invention, one of the articulated connections permits a pivoting and rolling movement of the car bodies, the wagon bodies are advantageously not subjected to any torsional stress which could cause damage.

Advantageous refinements of the invention are specified in the subclaims.

The invention will be described in more detail below with reference to exemplary embodiments which are each illustrated in their basic form in the drawing.

Figs 1 to 3 show two car bodies of a rail vehicle with a first embodiment of the articulated connection according to the invention, Fig. 1 showing the neutral position, Fig. 2 showing a pure rolling movement and Fig. 3 showing a pure pivoting movement.

Fig. 4 shows two car bodies of a rail vehicle with a second embodiment of the articulated connection according to the invention in a neutral position.

Figs 5, 6 and 7 each show different embodiments and arrangements of a component for limiting the rolling movements

using the example of the first embodiment of the articulated connection according to Fig. 1.

The car bodies 6, 7 are preferably components of a rail vehicle which is of modular design and has, for example, a total of three, five or more car bodies. The car body 6 can be supported on a bogie or set of running gear, while the car body 7 is embodied in the manner of a bridge and is borne by the supported car body 6 and a further supported car body (6) which is arranged to the right of the bridge-like car body 7 in the plane of the drawing in Figs 1 to 7. However it is also conceivable to support all the car bodies on bogies or sets of running gear.

All the car bodies of the multi-part rail vehicle are coupled by means of articulated connections which permit turning movements of the car bodies about the vertical axis when the vehicle travels through a bend. In a rail vehicle which has more than three parts, at least one articulated connection is embodied in such a way that the vehicle can carry out pitching movements about the transversal axis when traveling through a depression or over an elevation. So that rolling movements of the car bodies 6, 7 about the longitudinal axis of the vehicle are also permitted, the articulated connection shown has a connecting element 2 which, according to Figs 1 to 3 and 4 to 7, is embodied as a rigid connector rod and is connected to the two car bodies 6, 7 by means of ball and socket joints 3, 4. In the alternative embodiment which is shown in Fig. 4, the connecting element 2 is embodied as a twistable connector rod and is connected to the two car bodies 6, 7 by means of single-axle joints 8, 9. In the lower region, the car bodies 6, 7 are coupled by means of a vehicle joint 1 which can move in a spherical fashion. One of the rotational axes which is formed by the ball and socket joints 3, 4 or by the single-axle joints 8, 9 and the rotational axis of the vehicle joint 1

preferably lie on the same vertical axis 10. As a result of this, satisfactory pivoting about the vertical axis is possible.

The rolling movement is basically limited by the length of the connecting element 2. However, it is recommended to limit the rolling movements by a component 5 which has a damping function and includes the function of a stop. Furthermore, the component 5 can have a spring-loading function. According to Fig. 5, the component 5 acts on the two car bodies 6, 7. According to Figs 6 and 7, the component 5 can also be arranged in such a way that it acts on one of the car bodies 6, 7 at one end, and on one of the ball and socket joints 3, 4 at the other. The arrangements, shown in Figs 5 to 7, of the component 5 which limits the rolling movements can readily be transferred to the second embodiment of the articulated connection according to the invention which is illustrated in Fig. 4.